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(54) **SYRINGE STORAGE CONTAINER**

(71) Applicant: **Terumo Kabushiki Kaisha**, Tokyo (JP)

(72) Inventors: **Yoichiro Iwase**, Yamanashi (JP); **Junichi Ogawa**, Yamanashi (JP); **Kouichi Tachikawa**, Yamanashi (JP)

(73) Assignee: **TERUMO KABUSHIKI KAISHA**, Tokyo (JP)

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A61M 5/34	(2006.01)

(52) **U.S. Cl.**

CPC ***A61M 5/002*** (2013.01); ***A61M 5/008*** (2013.01); ***A61M 5/3134*** (2013.01); *A61M 5/344* (2013.01); *A61M 5/347* (2013.01); *A61M 2005/3104* (2013.01)

(58) **Field of Classification Search**

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USPC 206/366, 443, 364, 365; 211/60.1, 74

See application file for complete search history.

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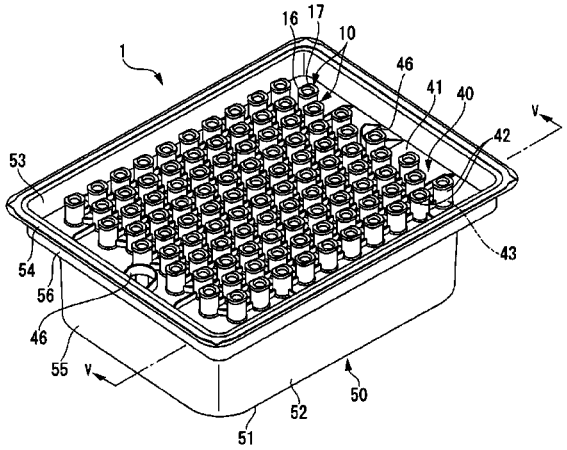
Primary Examiner — Bryon Gehman

(74) *Attorney, Agent, or Firm* — Foley & Lardner LLP

(57) **ABSTRACT**

A syringe container includes a cylindrical syringe including a distal end portion having a discharge opening for discharging a liquid, a proximal end portion, and a side peripheral section connected to the distal end portion and the proximal end portion; an attachment member configured to be attached to the distal end portion and having an outer radius larger than an outer radius of the side peripheral section; a container body including a bottom portion and a peripheral wall portion extending upward from a periphery of the bottom portion; and a syringe holding section configured to be placed within the peripheral wall portion so as to face the bottom portion.

15 Claims, 5 Drawing Sheets



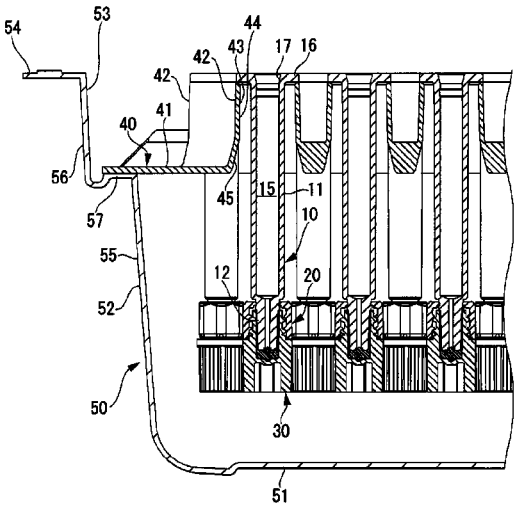


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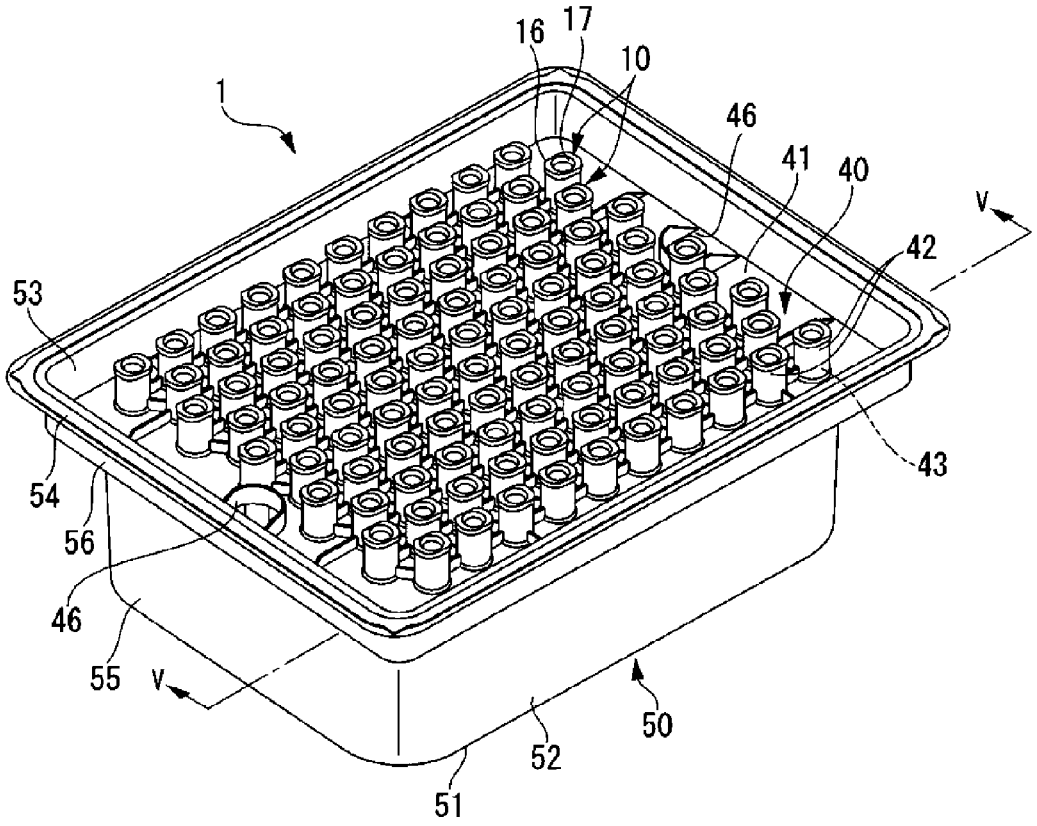
FIG. 1



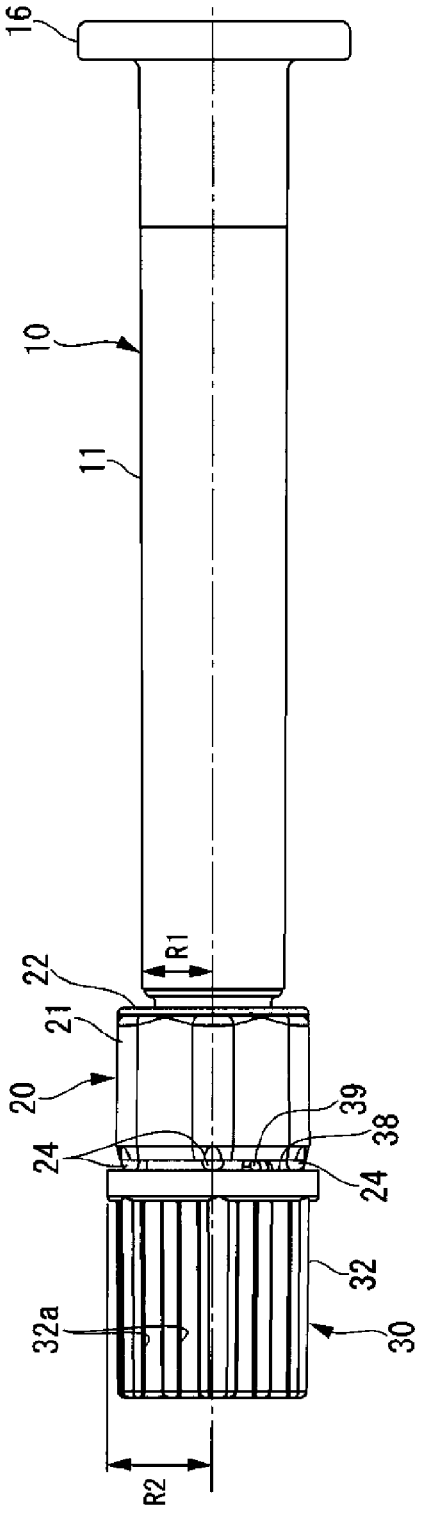


FIG. 2A

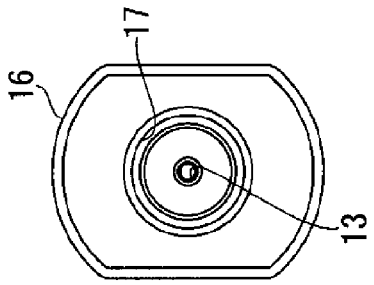


FIG. 2C

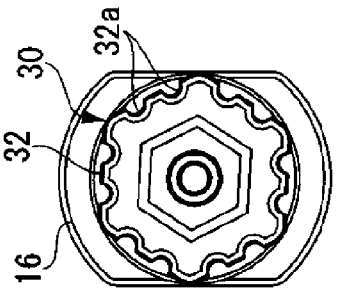


FIG. 2B

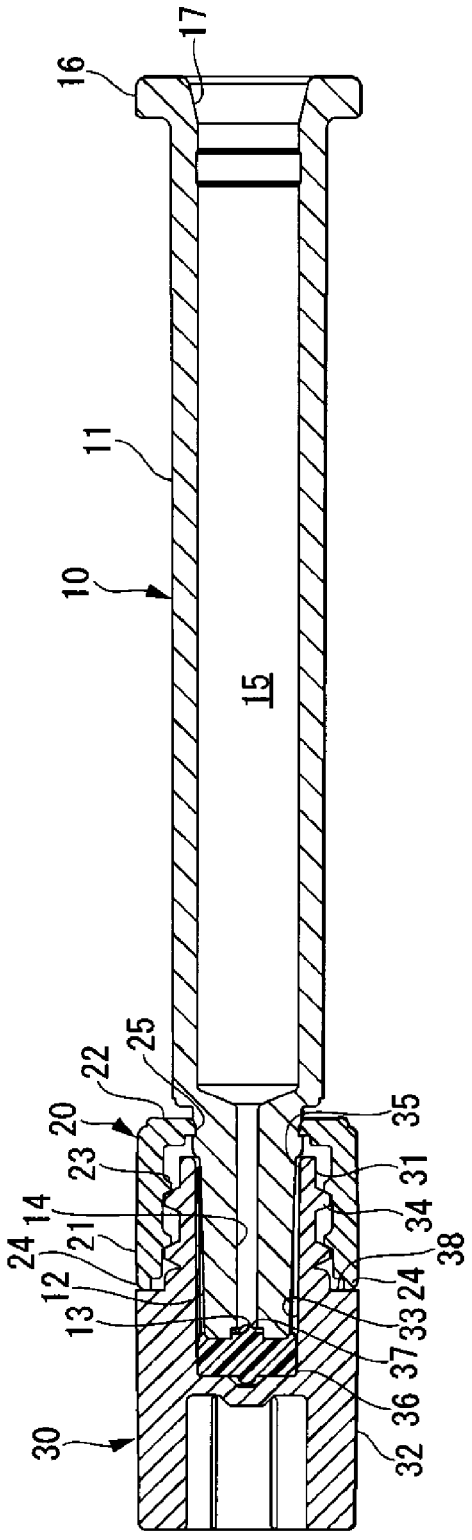


FIG. 3

FIG. 4A

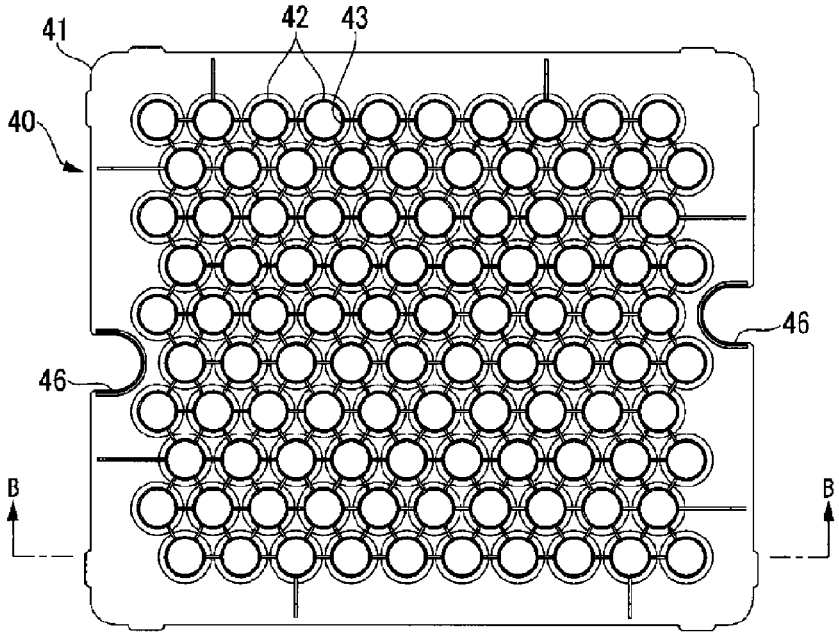


FIG. 4B

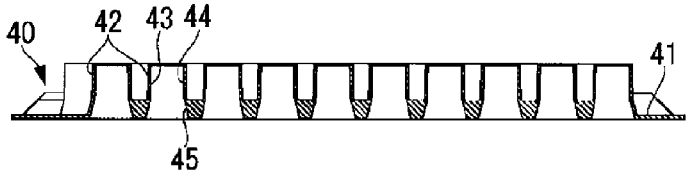


FIG. 4C

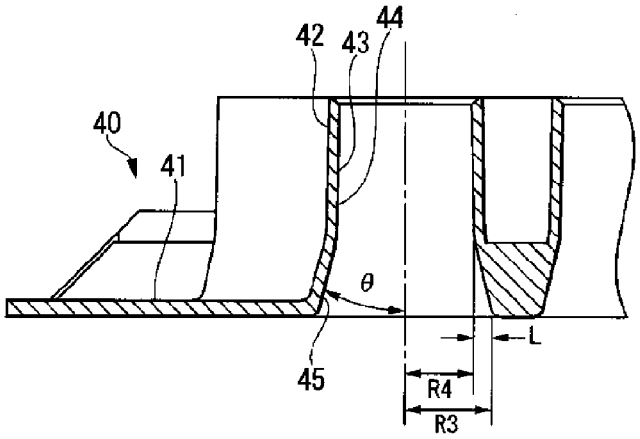
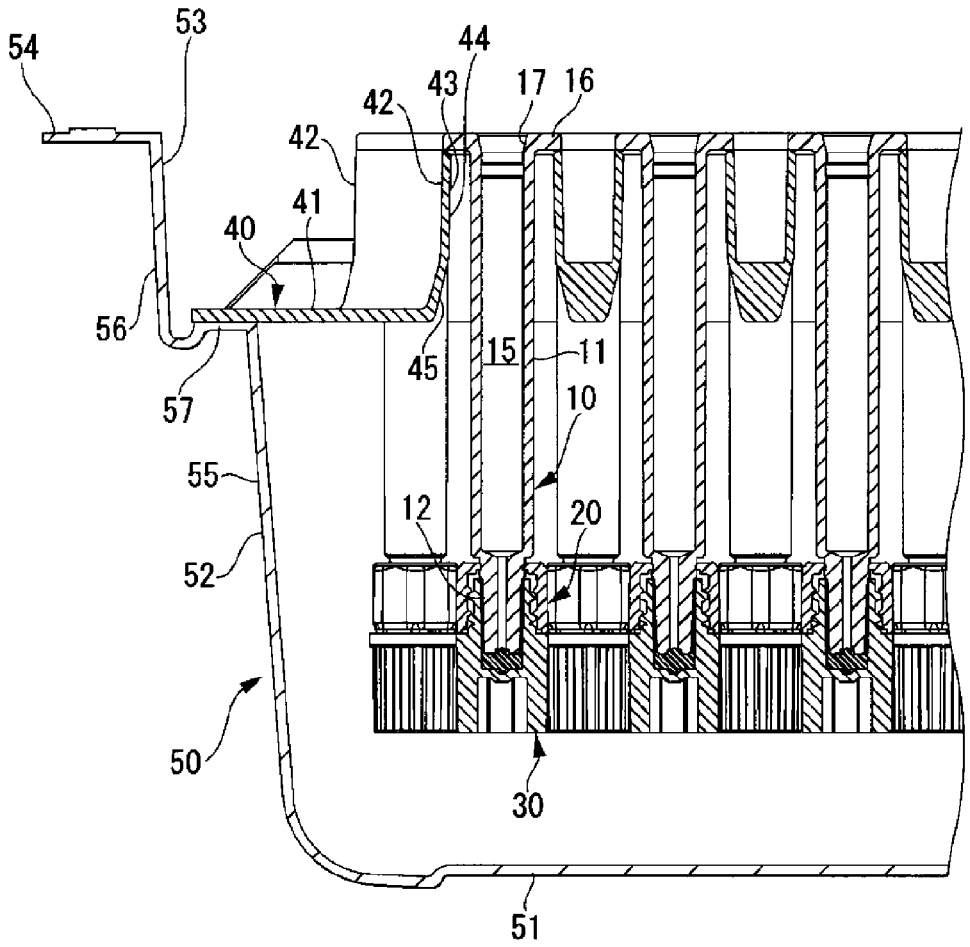


FIG. 5



SYRINGE STORAGE CONTAINER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application filed under 35 U.S.C. 111(a) claiming the benefit under 35 U.S.C. §§120 and 365(c) of PCT International Application No. PCT/JP2012/066246 filed on Jun. 26, 2012, the entire contents of which is hereby incorporated by reference in its entirety.

BACKGROUND

1. Technical Field

The present disclosure relates to a syringe container for containing a plurality of syringes.

2. Background Art

Conventionally, a syringe container that can hold a plurality of syringes upright is used when transporting or storing syringes before the syringes are filled with liquid medicines. Such a syringe container is configured with a box-shaped container body with an opened top and a syringe holding section that can hold a plurality of syringes upright. Inside the container body, a ledge-like section is provided to support the syringe holding section. The syringe holding section is configured with a plate-like member having a plurality of through-holes. The syringe is inserted in the through-hole and the flange section provided on the end portion of the syringe is placed on the rim of the through-hole. The syringe is thereby held in the syringe holding section. Using such a syringe container, a plurality of syringes can be held upright with filling ports for liquid medicine of the syringes facing upward.

Generally, if syringes and liquid medicines are produced by different companies, the syringe container is produced by the company producing syringes and shipped to the company producing liquid medicines. Liquid medicines are filled in syringes in the company producing liquid medicines. The company manufacturing syringes can use the aforementioned syringe container to store and transport a plurality of syringes at the same time. The company producing liquid medicines can simply take out the syringe holding section holding a plurality of syringes from the container and set them in an apparatus for filling liquid medicines. This makes the operation of filling liquid medicines into syringes efficient.

Such a known container is discussed in WO 2008/107961 A. The medical container discussed in WO 2008/107961 A includes a box-like container body with an opened top, a plate-like holding unit provided inside the container body, and a plurality of cylindrical holding sections formed in the holding unit.

When containing an injection sleeve with a cap thereon in the medical container, the flange section of the injection cylinder abuts the holding unit as the injection cylinder advances in the sleeve hole of the holding unit. The injection cylinder is thus held in the holding unit and contained in the container body.

A conventional syringe including a Luer lock that connects the distal end of a syringe (injection cylinder) and a cap (nozzle cap) or a needle holding member that holds an injection needle and a thread is known. When a cap to be attached to a Luer-lock syringe having a small diameter and a small injection volume, for example, 0.5 milliliters (ml), is formed with an outer diameter equal to the outer diameter of the syringe body, the cap diameter also becomes small, which makes it difficult to rotate the cap to remove.

To solve such problem, the cap can be formed with an outer diameter larger than the outer diameter of the syringe body.

If a syringe attached with a cap having an outer diameter larger than the outer diameter of the syringe body is contained in the medical container discussed in WO 2008/107961 A, the difference between the diameter of the sleeve hole of the holding unit and the outer diameter of the cap becomes small.

As for a typical medicine, particularly for protein preparations such as vaccines, the protein preparation is filled in the syringe contained in the medical container. The syringe is checked for shipping and then transferred to a packing line. Since the preparation cannot be stored under room temperature, the preparation is generally stored in a refrigerator until checked for shipping. In order to efficiently transfer the syringes filled with medicine to the packing line and to efficiently store the syringes in the refrigerator, the syringes are lined up in one direction in a rondo tray and stacked to be stored. To line up the syringes in the rondo tray, the syringes are quickly pulled out vertically by an automatic holding unit pull-out machine.

When the degree of shift between the center axis of the syringe held in the holding unit and the center axis of the sleeve hole is large, the cap may abut the inner rim of the holding section forming the through-hole when the syringe is pulled out. When the syringe is further pulled out with the cap abutting the holding section, the holding unit may rise with the syringe.

Then when the holding unit and the cap make relative motions and release each other, the holding unit falls and makes vibration which might cause other syringes held in the holding unit to come out of the sleeve hole of the holding section. When a syringe comes out of the sleeve hole of the holding section, the liquid filled in the syringe may spill out of the syringe or the syringe may be damaged.

SUMMARY OF INVENTION

In light of the foregoing, one object of the present invention is to provide a syringe container that allows a syringe to be pulled out without raising the syringe holding section.

According to one embodiment, a syringe container includes a syringe, an attachment member, a container body, and a syringe holding section.

In one aspect, the cylindrically formed syringe includes a distal end portion with a discharge opening for discharging the filled liquid, a proximal end portion located opposite to the distal end portion, and a side peripheral section connected to the distal end portion and the proximal end portion. The attachment member is attached to the distal end portion and has an outer radius larger than an outer radius of the side peripheral section.

In one aspect, the container body includes a bottom portion located at the bottom end and a peripheral wall portion continuously extending upward from the periphery of the bottom portion. The syringe holding section is placed within the peripheral wall portion to face the bottom portion and has a through-hole in which the syringe is vertically inserted, and holds the syringe by inserting the syringe in the through-hole. Further, a peripheral surface forming the through-hole has an upper end of which radius is larger than the outer radius of the attachment member, a bottom end of which radius is larger than the radius of the upper end, and a tapered section having a diameter reducing as the tapered section extends upward from the bottom end.

In the syringe container thus configured, the peripheral surface forming the through-hole of the syringe holder has a tapered section. The diameter of the tapered section reduces as the tapered section extends upward from the bottom end of the peripheral surface.

Accordingly, when the syringe attached with the attachment member and held in the syringe holding section is to be pulled out from the through-hole, if the degree of the shift between the center axis of the syringe and the center axis of the through-hole is large, the attachment member or the distal end portion of the syringe attached with the attachment member makes contact with the tapered section. As the attachment member or the distal end portion of the syringe slides upward along the tapered surface of the tapered section, the degree of shift between the center axis of the syringe and the center axis of the through-hole decreases. This prevents the attachment member or the distal end portion of the syringe from abutting the outer rim of the through-hole of the syringe holding section. The syringe can thus be pulled out without raising the syringe holding section.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of a syringe container according to an embodiment of the present invention.

FIG. **2**A is a side view of the syringe in FIG. **1** with a cap attached.

FIG. **2**B is a front view of the syringe in FIG. **1** with the cap attached.

FIG. **2**C is a rear view of the syringe in FIG. **1** with the cap attached.

FIG. **3** is a sectional view of the syringe in FIG. **1** with the cap attached.

FIG. **4**A is a top view of the syringe holding section in FIG. L.

FIG. **4**B is a sectional view of the syringe holding section in FIG. **1** taken along the line B-B in FIG. **4**A.

FIG. **4**C is an enlarged view of a portion of the syringe holding section illustrated in FIG. **4**B.

FIG. **5** is a sectional view of the syringe container taken along the line V-V in FIG. **1**.

DETAILED DESCRIPTION

A syringe container according to an embodiment of the present invention will be described below referring to FIGS. **1** to **5**. The same component is appended with the same reference sign in the drawings. The present invention is not limited to the embodiment described below.

Configuration of Syringe Container

A configuration of a syringe container **1** of the embodiment will be described referring to FIG. **1**. FIG. **1** is the perspective view of the syringe container **1** of the embodiment.

The syringe container **1** of the embodiment is used to transfer and store a plurality of syringes **10** at the same time. As illustrated in FIG. **1**, the syringe container **1** is configured with a container body **50** formed in an approximately square-box-shape, a syringe holding section **40** placed within the container body **50**, a syringe **10** held in the syringe holding section **40**, and a cap **30** (see FIGS. **2**A to **2**C) attached to the syringe **10**. The syringe **10** with a cap **30** attached to the distal end portion thereof is inserted in a through-hole **43** formed in the syringe holding section **40** to be held in the syringe holding section **40**.

The syringe **10** and the cap **30** of the embodiment will be described referring to FIGS. **2**A to **3**.

FIGS. **2**A to **3** illustrate the syringe **10** attached with the cap **30** according to the embodiment.

Syringe

As illustrated in FIGS. **2**A to **3**, the syringe **10** of the embodiment is formed in an approximately cylindrical shape. With the distal end of the syringe **10** plugged with the cap **30**, the sleeve hole of the syringe **10** is filled with liquid such as a liquid medicine.

The syringe **10** includes an approximately cylindrically formed side peripheral section **11**, a discharge section (distal end portion) **12** (see FIG. **3**) formed on a first end of the side peripheral section **11**, and a flange section (proximal end portion) **16** formed on a second end of the side peripheral section **11**.

The side peripheral section **11** is integrally formed with the discharge section **12** and the flange section **16**. That is, the side peripheral section **11** continues to the discharge section **12** and the flange section **16**. A liquid chamber **15** for storing the filled liquid medicine is formed inside the side peripheral section **11**.

The outer radius R**1** (see FIGS. **2**A to **2**C) of the side peripheral section **11** can suitably be determined according to applications and the amount of liquid medicine stored in the liquid chamber **15**. For example, when the amount of liquid medicine is 0.5 ml, the outer radius R**1** of the side peripheral section **11** is preferably within a range from 3.4 to 4.1 mm. For example, when the amount of liquid medicine is 1 ml, the outer radius R**1** of the side peripheral section **11** is preferably within a range from 4.05 to 4.7 mm. In the embodiment, the amount of liquid medicine to be stored in the liquid chamber **15** is 0.5 ml and the outer radius R**1** of the side peripheral section **11** is 3.5 mm.

As illustrated in FIG. **3**, the discharge section **12** is formed in an approximately cylindrical shape that projects from one of ends of the side peripheral section **11** such that the axis of the discharge section **12** is identical to the center axis of the side peripheral section **11**. The outer radius of the discharge section **12** is smaller than the outer radius R**1** of the side peripheral section **11**. The discharge section **12** is formed in a tapered shape where the outer radius gradually reduces toward the distal end. A discharge opening **13** for discharging a liquid medicine is formed in the distal end portion of the discharge section **12**. Further, a discharge passage **14** is formed in the discharge section **12** to communicate with the discharge opening **13** and the liquid chamber **15** of the side peripheral section **11**. The liquid medicine stored in the liquid chamber **15** may be discharged through the discharge opening **13**.

A Luer-lock portion **20** is provided on the discharge section **12**. The Luer-lock portion **20** is an approximately cylindrically shaped member arranged to be concentric with the side peripheral section **11**. The Luer-lock portion **20** includes a sleeve portion **21** extending along the center axis and an engagement portion **22** extending inward from a first end portion of the sleeve portion **21**.

The outer radius of the sleeve portion **21** is larger than the outer radius R**1** of the side peripheral section **11**. An internal thread **23** is integrally formed on the inner peripheral surface of the sleeve portion **21**. On a second end portion of the sleeve portion **21**, a plurality of projections **24** projecting along the center axis is formed. The projections **24** are arranged along the circumferential direction about the center axis, evenly spaced by a predetermined interval.

An engagement hole **25** is formed in the approximately middle portion of the engagement portion **22**. The discharge section **12** is inserted in the engagement hole **25** and then the engagement portion **22** engages with the proximal end of the discharge section **12**, whereby a Luer-lock portion **20** is attached to the discharge section **12**.

The flange section **16** extends radially outward from the second end portion of the side peripheral section **11** and is formed in an approximately oval-shape when viewed from the rear side. A filling port **17** is formed in the approximately middle portion of the flange section **16** and communicates with the liquid chamber **15** of the side peripheral section **11**. The filling port **17** is formed in a funnel-shape so that the liquid medicine can easily be filled in the liquid chamber **15**. The outer radius of a portion of the flange section **16** is larger than the inner radius of the upper end of the support cylinder **42** forming the through-hole **43** of the syringe holding section **40** which will be described later. Thus, when the syringe **10** is inserted, with the discharge section **12** of the syringe **10** pointing downward, in the through-hole **43** of the syringe holding section **40** from above, the flange section **16** is supported by the support cylinder **42** of the syringe holding section **40** and thereby the syringe **10** is held in the syringe holding section **40**. The shape of the flange section **16** is not limited to the oval-shape as in the embodiment and may be, for example, an annular shape.

A resin is used as the material of the syringe **10** in the embodiment, though various types of metal and glass may be used. The Luer-lock portion **20** may be formed integrally with the discharge section **12**.

Cap

The cap **30** is formed of an approximately cylindrically shaped resin and includes a small diameter section **31**, a large diameter section **32**, and a discharge section insertion hole **33**.

The small diameter section **31** is provided in a first end of the cap **30** and has an outer radius smaller than the large diameter section **32** provided in a second end of the cap **30**. The small diameter section **31** and the large diameter section **32** are integrally formed. An external thread **34** is formed on the outer peripheral surface of the small diameter section **31** which engages with the internal thread formed in the Luer-lock portion **20** of the syringe **10**.

The discharge section insertion hole **33** is provided within the cap **30** and extends along the center axis of the cap **30**. A first end of the discharge section insertion hole **33** communicates with an aperture **35** provided in a first end of the small diameter section **31** as to be opened to the outside. A second end of the discharge section insertion hole **33** is closed. An approximately cylindrically shaped packing **36** provided as an elastic member (e.g., a rubber) engages with the other end of the discharge section insertion hole **33**. A packing projection **37** projecting along the center axis is formed in the approximately middle portion of the packing **36**.

A contact face **38**, which radially extends inward to the outer periphery of second end of the small diameter section **31**, is formed on one of ends of the large diameter section **32**. On the contact face **38**, a plurality of cap projections **39** (see FIGS. **2**A to **2**C) projecting along the center axis is formed. The cap projections **39** are arranged along the circumferential direction about the center axis and evenly spaced by a predetermined interval.

A plurality of grooves **32***a* extending along the center axis is formed on the outer peripheral surface of the large diameter section **32**. The grooves are evenly spaced by a predetermined interval. The grooves produce large friction between a finger of a user when the cap **30** is to be removed from the syringe **10**. The user can easily rotate the cap **30** in the removal direction.

The outer radius R**2** of the large diameter section **32** is larger than that of the Luer-lock portion **20** of the syringe **10** and the outer radius R**1** of the side peripheral section **11**. Typically, a syringe configured with a cap, a lock, and a packing must secure liquid-tightness under sterilizing procedures, transportation of products, vibration, and dropping of the product until the validated date comes. To secure liquid-tightness, a seal is attached to the cap to prevent loosening, or alternatively, the cap is tightened by a certain degree of torque to push the distal end portion of the discharge section of the syringe into the packing. In such method, considering dimensional tolerances in the production of the cap, the lock, and the packing, the distal end portion of the discharge section has to be pushed into the packing by 0.5 mm or more. When a user wishes to release the liquid-tightness, the user should provide a certain degree of torque to rotate the cap for uncapping. The larger the cap size (outer radius) is, the larger the produced torque is, making it easy to uncap. Among those syringes configured with a cap, a lock, and a packing sold on the market, the smallest size of the cap of the syringe is about 8.0 mm.

As will be described below, the difference between the outer radius R**2** of the large diameter section **32** and the outer radius R**1** of the side peripheral section **11** is preferably within a range from 1 to 2 mm. Hereinafter, the difference between the outer radius R**2** of the large diameter section **32** and the outer radius R**1** of the side peripheral section **11** is referred to as syringe radius difference. The outer radius R**2** of the large diameter section **32** is 5 mm in the embodiment. That is, the syringe radius difference in the embodiment is 1.5 mm which is the difference between 5 mm, the outer radius R**2** of the large diameter section **32**, and 3.5 mm, the outer radius R**1** of the side peripheral section **11**.

By inserting the discharge section **12** in the discharge section insertion hole **33**, inserting the small diameter section **31** of the cap **30** in the sleeve hole of the sleeve portion **21** of the Luer-lock portion **20**, and rotating the attached cap **30** by a predetermined degree, the external thread **34** of the small diameter section **31** engages with the internal thread **23** of the Luer-lock portion **20**. The cap projection **39** first contacts the projection **24** of the sleeve portion **21** and slides over the projection **24** of the sleeve portion **21**, and then the contact face **38** of the cap **30** contacts the distal end of the projection **24** of the sleeve portion **21**. The cap **30** is thereby connected to the Luer-lock portion **20** and attached to the syringe **10**.

The distal end portion of the discharge section **12** of the syringe **10** is then pushed into the packing **36**, and thereby the packing projection **37** plugs the discharge opening **13** of the discharge section **12**. This prevents the liquid medicine stored in the liquid chamber **15** from leaking outside of the syringe **10** through the discharge passage **14** and the discharge opening **13**.

When the cap **30** is attached, the projection **24** of the sleeve portion **21** making contact with the cap projection **39** restricts the cap **30** rotating in the removal direction. If a predetermined degree or greater force is applied to the cap **30** in the removal direction, the cap projection **39** slides over the projection **24** of the sleeve portion **21**, and thereby the cap **30** can rotate in the removal direction, in other words, the cap **30** can be removed.

Syringe Holding Section

The syringe holding section **40** will be described referring to FIGS. **4**A to **4**C. FIGS. **4**A to **4**C illustrate the syringe holding section **40**.

The syringe holding section **40** is a resin member including a square-plate-shaped base plate **41** and a plurality of support cylinders **42** projecting from the top face of the base plate **41**. A through-hole **43** penetrating the base plate **41** is formed within the support cylinder **42** to insert the syringe **10** therein.

The inner peripheral surface (peripheral surface) **44** of the support cylinder **42** forming the through-hole **43** has an upper end which has a radius larger than the outer radius R**2** of the large diameter section **32** and a bottom end which has a radius larger than the radius of the upper end. The inner peripheral surface **44** has a tapered section **45** from the bottom end to the approximately middle portion of the support cylinder **42** where the radius reduces as the tapered section **45** extends upward. The tapered shape of the tapered section **45** may be a linear taper, an exponential curve taper, or an inverted parabolic curve. In particular, a linear taper is preferably used. From the approximately middle portion to the upper end of the support cylinder **42**, the radius of the inner peripheral surface **44** is constant.

As will be described below, the radius R**3** of the bottom end of the tapered section **45** and the radius R**4** of the upper end of the tapered section **45** are preferably set such that the difference (hereinafter referred to as tapered distance L) is larger than the syringe radius difference. In the embodiment, the radius R**3** of the bottom end of the tapered section **45** is 7.5 mm, and the radius R**4** of the upper end of the tapered section **45** is 5.865 mm. That is, the tapered distance L in the embodiment is 1.635 mm, which is larger than the syringe radius difference, which is 1.5 mm.

As will be described below, if the syringe radius difference is 1 mm and the tapered distance L is within a range from 1 to 4 mm, the inclination angle of the tapered section **45** to the center axis of the through-hole **43** (hereinafter referred to as taper angle θ) is preferably within a range from 5 to 40 degrees. If the syringe radius difference is 2 mm and the tapered distance L is within a range from 2 to 4 mm, the taper angle θ is preferably within a range from 5 to 30 degrees. The taper angle θ is 13.35 degrees in the embodiment.

A plurality of support cylinders **42** is staggeredly arranged on the base plate **41**. The support cylinders **42** are evenly spaced by a predetermined distance. In this manner, the distance between adjacent support cylinders **42** is approximately constant, and thereby the distance between syringes **10** inserted through the support cylinders **42** to be held is approximately constant. This prevents the contact between adjacent syringes **10** caused by vibration or the like during transportation of the syringe container **1**.

In each of two opposing sides of the base plate **41**, an approximately half-circle-shaped notch **46** is formed. As will be described below, by putting a finger or the like in the notch **46**, the syringe holding section **40** can easily be raised, so that the syringe holding section **40** placed within the container body **50** can easily be taken out from the syringe holding section **40**.

Container Body

The container body **50** will be described referring to FIG. **5**. FIG. **5** is a sectional view of the syringe container **1** taken along the line V-V in FIG. **1**.

The container body **50** is a resin member formed in an approximately square-box-shape. As illustrated in FIG. **5**, the container body **50** includes an approximately square-plate-like bottom portion **51** and a peripheral wall portion **52** extending upward from the outer periphery of the bottom portion **51**. The container body **50** further includes an opening **53** surrounded by the upper end of the peripheral wall portion **52** and a flange **54** surroundingly continuing to the upper end of the peripheral wall portion **52**. The internal space of the container body **50** surrounded by the peripheral wall portion **52** and the bottom portion **51** serves as a container space for containing the syringe holding section **40** and the syringe **10**.

The peripheral wall portion **52** includes a lower peripheral wall portion **55**, an upper peripheral wall portion **56**, and a ledge section **57**. The lower peripheral wall portion **55** extends upward with an outward inclination from the outer periphery of the bottom portion **51**. The ledge section **57** is formed in a frame-shape extending outward of the lower peripheral wall portion **55** from the upper edge of the lower peripheral wall portion **55** so as to be parallel to the bottom portion **51**. The upper peripheral wall portion **56** extends upward from the outer periphery of the ledge section **57**.

The flange **54** is formed in a frame-shape extending outward from the upper edge of the upper peripheral wall portion **56** so as to be parallel to the bottom portion **51**. A film (not shown) to seal the syringe container **1** when shipping the syringe container **1** is attached to the flange **54**. As for the film, a moisture permeable and waterproof sheet that is usable under a sterilizing process employing high temperature steam or gas such as high pressure steam sterilization (autoclaving) and EOG (ethylene oxide gas) sterilization is used.

Preferably, the resin used for the syringe **10**, the cap **30**, the syringe holding section **40**, and the container body **50** is such that the property does not change under the sterilization process employing high temperature steam or gas such as high temperature steam sterilization and EOG sterilization. Such resins include resistant resins, for example, polypropylene, polystyrene, polyethylene, polycarbonate, ABS resin, PET, or the like. Further, preferably, the syringe holding section **40** and the container body **50** are substantially transparent or semitransparent to secure visibility of the inside of the container body **50**. Such materials, among the aforementioned resins, include polycarbonate, polystyrene, and PET.

Referring to FIG. **5**, the state of the syringe container **1** according to the embodiment where the syringe **10** attached with the cap **30** is held in the syringe holding section **40** placed within the container body **50** will be described. FIG. **5** is a sectional view of the syringe container **1** taken along the line V-V in FIG. **1**.

As illustrated in FIG. **5**, the syringe holding section **40** is inserted in the container body **50** from above to be held therein, and the bottom face of the outer peripheral portion of the base plate **41** of the syringe holding section **40** makes contacts with the top surface of the ledge section **57**. That is, the syringe holding section **40** is mounted on the ledge section **57** to be placed within the container body **50**. The ledge section **57** restricts the syringe holding section **40** from descending in the container body **50**.

The base plate **41** of the syringe holding section **40** faces the bottom portion **51** of the container body **50**.

The syringe **10** attached with the cap **30** is inserted in the through-hole **43** of the syringe holding section **40**. The syringe holding section **40** holds the syringe **10** by way of the upper end of the support cylinder **42** supporting the flange section **16** of the syringe **10**.

Now, the result of the experiment carried out for the syringe container **1** of the embodiment will be described. In

the experiment, the abutting of the syringe **10** against the syringe holding section **40** is tested for cases with different values of the taper angle θ, the syringe radius difference, and the tapered distance L. In the experiment, syringe containers **1** corresponding to each combination of the taper angle θ, the syringe radius difference, and the tapered distance L are prepared. For each syringe container **1**, the syringe **10** is pulled out from the syringe container **1** to test whether the syringe holding section **40** rises.

Specifically, for this experiment, three types of caps **30** of 1, 2, and 3 mm are used. Further, 20 types of syringe holding sections **40** are used where the tapered distance L has variation of 1, 2, 3, and 4 mm and the tapered angle θ of the tapered section **45** has variation of 5, 10, 30, 40, and 50 degrees.

In the experiment, one syringe **10** attached with a cap **30** is inserted in the through-hole **43** of each syringe holding section **40** fixed to a jig (not shown) with a large degree of shift provided between the center axis of the syringe **10** and the center axis of the through-hole **43**. In this manner, when the syringe **10** is pulled up, the Luer-lock portion **20** of the syringe **10** or the cap **30** makes contacts with the tapered section **45** of the inner peripheral surface **44** of the syringe holding section **40**.

In this experiment, the syringe **10** inserted in the syringe holding section **40** is pulled upward by a robot arm (not shown) to test whether the syringe **10** or the cap **30** abuts and raises the syringe holding section **40**. The speed of pulling up the syringe **10** by the robot arm is set to 500 mm/min. Three tests are performed for each combination of the cap **30** and the syringe holding section **40**.

The results of the experiment are shown in Table 1.

TABLE 1

	Tapered Distance L / Taper	1 mm					2 mm					3 mm					4 mm				
	Angle θ	5°	10°	30°	40°	50°	5°	10°	30°	40°	50°	5°	10°	30°	40°	50°	5°	10°	30°	40°	50°
Syringe Radius Difference	1 mm	O	O	O	O	X	O	O	O	O	X	O	O	O	O	X	O	O	O	O	X
	2 mm	X	X	X	X	X	O	O	O	X	X	O	O	O	X	X	O	O	O	X	X
	3 mm	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table **1** shows the result of the experiment for the combinations of the cap **30** and the syringe holding section **40**, where "X" indicates that the syringe holding section **40** has risen one or more times and "O" indicates that the syringe holding section **40** has never risen.

The result of the experiment shows that the preferable syringe radius difference is within a range from 1 to 2 mm. It shows that the tapered distance L is preferably larger than the syringe radius difference. If the syringe radius difference is 1 mm and the tapered distance L is within a range from 1 to 4 mm, the preferable taper angle θ is within a range from 5 to 40 degrees. If the syringe radius difference is 2 mm and the tapered distance L is within a range from 2 to 4 mm, the preferable taper angle θ is within a range from 5 to 30 degrees.

In the syringe container **1** of the embodiment, the inner peripheral surface **44** of the support cylinder **42** forming the through-hole **43** has the tapered section **45** from the bottom end to the approximately middle portion of the support cylinder **42** where the radius reduces as the tapered section **45** extends upward.

Provided in such a manner, when the syringe **10** attached with the cap **30** held in the syringe holding section **40** is to be pulled out from the through-hole **43**, if the degree of the shift between the center axis of the syringe **10** and the center axis of the through-hole **43** is large, the Luer-lock portion **20** or the cap **30** makes contact with the tapered section **45**. The Luer-lock portion **20** or the cap **30**, after making contact with the tapered section **45**, slides upward along the tapered surface of the tapered section **45**, reducing the degree of shift between the center axis of the syringe **10** and the center axis of the through-hole. This prevents the Luer-lock portion **20** or the cap **30** from abutting the outer rim of the through-hole **43** of the syringe holding section **40**. The syringe **10** can thus be pulled out without raising the syringe holding section **40**.

Further, since the outer radius R**2** of the large diameter section **32** of the cap **30** is larger than the outer radius R**1** of the side peripheral section **11** of the syringe **10**, a user can easily remove the cap **30** from the syringe **10** even for a syringe **10** with a small diameter and a small injection volume, for example, 0.5 or 1 ml.

An embodiment to which the present invention is applied is thus described above. The description and the drawings of the embodiment constituting a portion of the disclosure of the invention do not limit the scope of the invention.

An embodiment provided with a cap **30** as the attachment member has been described, but the attachment member may be provided as a different member that can be attached to the distal end portion of the syringe **10**. For example, the member may be an injection needle holder for holding an injection needle.

An embodiment in which the support cylinder **42** projects from the top face of the base plate **41** has been described, but the support cylinder **42** may project upward and downward from the base plate **41**.

The support cylinder **42** may be formed to project downward from the bottom face of the base plate **41**. In this case, the flange section **16** of the syringe **10** is supported by the upper end of the support cylinder **42** and the top face of the base plate **41**.

The base plate **41** may be formed thick so that the through-hole **43** having the tapered section **45** is formed in the base plate **41** itself. In this case, the support cylinder **42** is omitted and the flange section **16** of the syringe **10** is supported by the top face of the base plate **41**.

It should be noted that other embodiments, exemplary embodiments, arts for operation, or the like carried out based on the aforementioned embodiment by those skilled in the art should all fall within the scope of the present invention.

What is claimed is:

1. An assembly comprising:

a cylindrical syringe including a distal end portion having a discharge opening for discharging a liquid, a proximal end portion arranged opposite the distal end portion, and a side peripheral section connected to the distal end portion and the proximal end portion;

an attachment member attached to the distal end portion and having an outer radius larger than an outer radius of the side peripheral section;

a container body including a bottom portion and a peripheral wall portion extending upward from a periphery of the bottom portion; and

a syringe holding section configured to be placed within the container body, surrounded by the peripheral wall portion, so as to face the bottom portion,

wherein the syringe holding section includes an inner peripheral surface that forms a through-hole, the syringe holding section configured to hold the syringe when the syringe is inserted in the through-hole,

wherein the inner peripheral surface includes an upper end having a radius larger than an outer radius of the attachment member, a bottom end having a radius larger than the radius of the upper end of the inner peripheral surface, and a tapered section having a radius that tapers from a larger radius to a smaller radius as the tapered section extends upward from the bottom end of the inner peripheral surface, and

wherein a difference between the radius of a bottom end of the tapered section and the radius of an upper end of the tapered section is equal to or larger than a difference between the outer radius of the attachment member and the outer radius of the side peripheral section.

2. The assembly according to claim **1**, wherein the radius of the attachment member is 4.0 mm or larger.

3. The assembly according to claim **1**, wherein an angle formed between a line parallel to the tapered section and a center axis of the through-hole is 5 to 40 degrees.

4. The assembly according to claim **1**, wherein a Luer-lock portion configured to be connected to the attachment member is provided on the distal end portion of the syringe.

5. The assembly according to claim **1**, wherein the assembly comprises a plurality of the cylindrical syringes.

6. The assembly according to claim **1**, wherein the syringe holding section includes a plurality of inner peripheral surfaces that each form a through hole.

7. The assembly according to claim **1**, wherein the tapered section extends no more than approximately half of the length of the inner peripheral surface.

8. The assembly according to claim **1**, wherein the attachment member is a cap configured to plug the discharge opening of the syringe.

9. The assembly according to claim **1**, wherein the syringe holding section includes a support cylinder and the syringe holding section is configured such that the inner peripheral surface that forms the through-hole is disposed in the support cylinder.

10. The assembly according to claim **9**, wherein the assembly comprises a plurality of the support cylinders.

11. The assembly according to claim **9**, wherein the tapered section extends no more than approximately half of the length of the support cylinder.

12. The assembly according to claim **9**, wherein the tapered section has a linear taper shape.

13. The assembly according to claim **1**,

wherein the peripheral wall portion comprises a ledge section, and

wherein the syringe holding section is configured to be placed within the container body, in contact with a top portion of the ledge section of the peripheral wall portion so that a base plate of the syringe holding section faces the bottom portion.

14. An assembly comprising:

a cylindrical syringe including a distal end portion having a discharge opening for discharging a liquid, a proximal end portion arranged on a side opposite the distal end portion, and a side peripheral section connected to the distal end portion and the proximal end portion;

an attachment member configured to be attached to the distal end portion and having an outer radius larger than an outer radius of the side peripheral section;

a container body including a bottom portion and a peripheral wall portion extending upward from a periphery of the bottom portion; and

a syringe holding section configured to be placed within the container body, surrounded by the peripheral wall portion, so as to face the bottom portion,

wherein the syringe holding section includes an inner peripheral surface that forms a through-hole, the syringe holding section configured to hold the syringe when the syringe is inserted in the through-hole,

wherein, the inner peripheral surface includes an upper end having a radius larger than an outer radius of the attachment member, a bottom end having a radius larger than the radius of the upper end of the inner peripheral surface, and a tapered section having a radius that tapers from a larger radius to a smaller radius as the tapered section extends upward from the bottom end of the inner peripheral surface,

wherein the syringe includes a flange section extending radially outward from the proximal end portion of the syringe,

wherein the syringe holding section includes a support cylinder and the syringe holding section is configured such that the inner peripheral surface that forms the through-hole is disposed in the support cylinder, and

wherein an outer radius of at least a portion of the flange section is larger than a inner radius of a upper end of the support cylinder.

15. An assembly comprising:

a cylindrical syringe including a distal end portion having a discharge opening for discharging a liquid, a proximal end portion arranged on a side opposite the distal end portion, and a side peripheral section connected to the distal end portion and the proximal end portion;

an attachment member configured to be attached to the distal end portion and having an outer radius larger than an outer radius of the side peripheral section;

a container body including a bottom portion and a peripheral wall portion extending upward from a periphery of the bottom portion; and

a syringe holding section configured to be placed within the container body, surrounded by the peripheral wall portion, so as to face the bottom portion,

wherein the syringe holding section includes an inner peripheral surface that forms a through-hole, the syringe holding section configured to hold the syringe when the syringe is inserted in the through-hole,

wherein, the inner peripheral surface includes an upper end having a radius larger than an outer radius of the attachment member, a bottom end having a radius larger than the radius of the upper end of the inner peripheral surface, and a tapered section having a radius that tapers from a larger radius to a smaller radius as the tapered section extends upward from the bottom end of the inner peripheral surface,

wherein the syringe holding section includes a support cylinder and the syringe holding section is configured

such that the inner peripheral surface that forms the through-hole is disposed in the support cylinder, and wherein the tapered section extends from a bottom end of the support cylinder to the approximately middle portion of the support cylinder.

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